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DEVELOPMENT OF AN IMPROVED JAN 6299

Report No. 5

Fifth Quarterly Progress Report

17 September 1962 through 31 December 1962

CONTRACT NO. DA-36-039-SC-85953

ORDER 6008-PP-61-81-81

Industrial Preparedness Group
USASSA
Philadelphia, Pennsylvania

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

OWENSBORO, KENTUCKY

DEVELOPMENT OF AN IMPROVED JAN 6299

Report No. 5

Fifth Quarterly Progress Report

17 September 1962 through 31 December 1962

OBJECTIVE: (1) To obtain better performance and greater reliability from the JAN 6299 by evaluating and adapting the latest tube technological advancements.

(2) To build 1000 tubes capable of passing Signal Corps Technical Requirements SCS-90 dated 1 July 1960.

CONTRACT NO. DA-36-039-SC-85953

SIGNAL CORPS INDUSTRIAL PREPAREDNESS
PROCUREMENT REQUIREMENTS (Scipper) No. 15
1 October 1958

SIGNAL CORPS TECHNICAL REQUIREMENTS
SCS-90, 1 July 1960

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

P U R P O S E

The purpose of this contract is to evaluate certain areas of advanced tube manufacturing techniques and apply them where feasible to JAN 6299 to result in a more reliable and better performing tube. The objective requirements for the improved tube are Signal Corps Technical Requirement SCS-90 (Improved JAN 6299) and operation at a tube temperature rating of 225°C. The areas under investigation are:

1. Improved alignment, concentricity and ceramic strength.
2. Improved anode to ceramic seal.
3. Temperature control at exhaust.
4. Improved application of cathode coating.
5. Improved cathode mounting.
6. Improve processing for higher temperature operation.
7. Improvement in humidity testing.
8. Improved exhaust fixturing.
9. Extended life test and tube failure analysis.

A B S T R A C T

The status of each of the nine projects is summarized. A mass spectrometric gas content analysis is given of SCS-90 humidity test failures.

N A R R A T I V E

PROJECT I IMPROVED ALIGNMENT CONCENTRICITY AND CERAMIC STRENGTH

In an effort to improve the alignment and concentricity of the tube, the ceramics and metal parts have been made to tighter tolerences. The ceramic composition has been changed from forsterite to 96% alumina in the heater, getter, and anode ceramics for greater strength. The cathode ceramic, when changed to 96% alumina, produced a median Cgk of 4.81 mmf. This data is given on pages 11, 12 and 13 of the Third Quarterly Progress Report. This is an increase of 31.8% over the bogy value of 3.65 mmf. Redesign of the cathode ceramic to compensate for a change of this magnitude, it is felt would be a major design change.

The improvements made in this project should enable improved exhaust fixturing (Project 9) to further improve alignment and concentricity of the tube. Project I is complete.

PROJECT II SEAL REDESIGN

a) Anode Seal

The copper anode is butt sealed to the 96% alumina ceramic with silver-copper eutectic. If care is taken when the ceramic metallizing is done, the Cgp centers near bogy. Continued life test of the two tubes whose 1000 hour life test data is in the Fourth Quarterly Progress Report showed a failure of 1000 hour life test limits after 4911 and 6035 hours.

b) Getter Shell and Cathode Shell Seals

The preseal is butt sealed with silver-copper eutectic and the ceramic is 96% alumina. No assembly problems are evident. Five tubes with hard solder anode seals and hard solder preseals passed 1000 hour life test limits for 3185, 3429, 4023, 4023 and 5147 hours.

This project is complete.

PROJECT III TEMPERATURE CONTROL AT EXHAUST

The temperature control equipment was moved from Scranton and installed at Owensboro. Shortly after installation, a component failed. This was repaired and the equipment was adjusted and used to monitor production exhaust schedules in order to determine some trial sealing schedules.

Tubes were exhausted to 5 trial sealing schedule, which are shown in Graph I. Exhaust results are shown in Table I. Runs 1 and 5 exhibited excessive lead flow from too much heat, which resulted in shorts. Runs 3 and 4 were too cold for good lead flow, causing high leaker shrinkage. Run 2, which closely approximates the present processing, showed the most promise. Repeatibility of the equipment in reproducing the set program seems quite good. On the basis of the results obtained, the temperature controller will be used to produce sustained runs of tubes with the present processing.

The equipment will be connected so that 2 exhaust sets will have the temperature controlled by same temperature controller. The exhaust sets are connected so that one bombarder supplies the r-f energy to 2 sets. When this is accomplished successfully, another temperature controller will be installed to control the sealing cycles of the 2" remaining exhaust sets.

TRIAL EXHAUST AND SEALING CYCLES

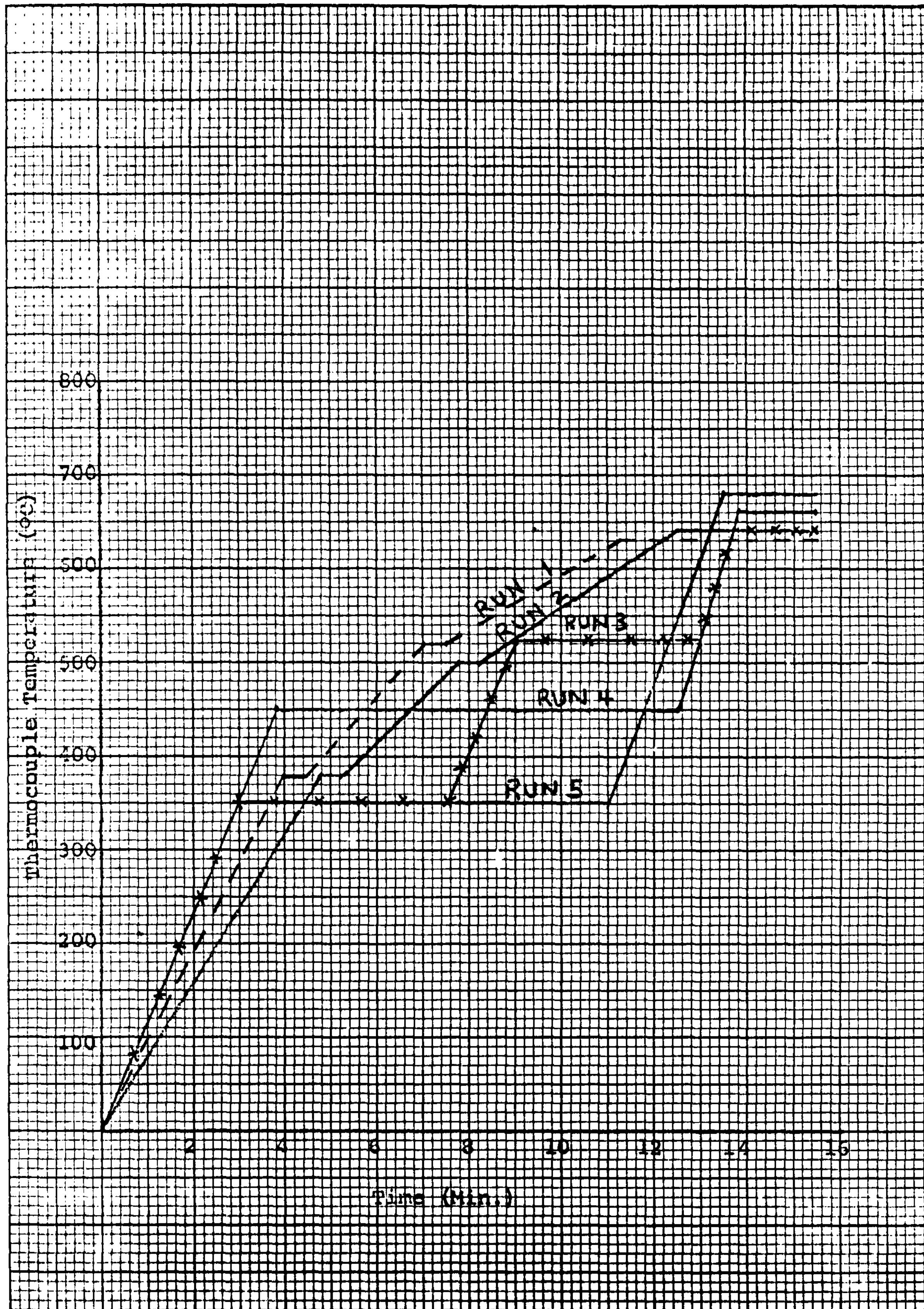


TABLE I

Results of Trial Sealing Schedules

Heating Schedule	No. Tubes	Exhaust Shrinkage
1	14	35.7%
2	28	3.6%
3	28	21.4%
4	21	19.0%
5	28	35.7%

PROJECT IV OPTIMIZE CATHODE COATING

The Paasche A - Automatic spray gun along with the improved spray fixtures continue to give uniform results in production. The spray density life tests indicated for favorable life test results, the density should be greater than 1.0 mg/mm^3. Cathode spray density has been adjusted from 0.9 - 1.05 mg/mm^3 to 1.25 - 1.35 mg/mm^3 on production tubes. The 1.25 - 1.35 mg/mm^3 density gave good life test results and is easier to activate than the higher density groups. The spraying of the higher cathode densities are also more difficult to control in production with the present cathode spray equipment. In view of data derived in this test, coupled with manufacturing experience, it is felt that the 1.25 - 1.35 mg/mm^3 density group will greatly improve the quality of the tube.

This project is complete.

PROJECT V IMPROVED CATHODE MOUNTING

No work was scheduled in this work period. In the next quarter tubes will be made with various cathode foil thickness and the cathode temperature will be determined. This will enable the correct thickness of cathode foil to be selected to give the proper cathode temperature for good life test results.

PROJECT VI IMPROVED PROCESSING FOR HIGHER TEMPERATURE OPERATION

a) Life Test

Seventeen (17) production tubes were run at 225°C anode temperature on the high temperature life rack. Within 24 hours 11 tubes became air leakers and 3 tubes developed open heaters due to burning open in air. The lot was discontinued and an adapter was made to determine where the leaks developed. This analysis disclosed all leaks were at the anode seal.

Seven (7) tubes with hard solder anode seals and hard solder preseals were put on high temperature life with the anode temperature at 225°C. These tubes demonstrated the hard solder anode is a much improved seal as 6 tubes were good at 129 hours. One tube failed as a grid to plate short in less than 8 hours. Electrical data is clouded by a high cathode temperature in these tubes. The data for these tubes is given in Table II.

b) Plating

The seven (7) tubes with hard solder seals had severe plating deterioration at 129 hours. The next lot of tubes that is run on high temperature life will have a nickle plating under the gold to prevent gold migration. The connections of the life rack itself corroded and these will be likewise nickle-gold plated.

TABLE II

High Temperature Life 225°C Anode Temperature

0 HOURS

Tube No.	I_f	E_c	I_s	E_b	Noise	Gain
1	301	1.13	12.0	65	8.0	18.1
2	300	0.97	10.6	77	8.3	17.6
3	305	0.90	10.5	84	8.5	17.1
4	301	2.10	15.0	49	10.2	14.4
5	308	0.78	10.4	83	8.1	18.1
6	301	0.81	12.0	65	8.0	17.7
7	301	0.44	8.0	95	8.5	17.7

129 HOURS

Tube No.	I_f	E_c	I_s	E_b	Noise	Gain
1	300	1.40	14.0	60	8.0	17.8
2	302	1.02	10.7	90	8.3	17.4
3	305	1.06	11.3	90	8.3	17.3
4	303	2.46	17.0	40	10.5	13.3
5	G - P Short					
6	305	1.02	11.6	80	8.0	17.8
7	301	0.68	8.5	100	8.3	17.2

Tubes with hard solder anode, hard solder preseal, regular plating, and high cathode temperature.

PROJECT VII IMPROVEMENT IN HUMIDITY TESTING

A mass spectrometric gas content analysis was performed on tubes that failed during humidity test. Sample analysis was performed as follows:

1. Each tube was cleaned with acetone and mounted in a device which could break it under vacuum. The breaker was also cleaned in acetone.
2. The breaker device was evacuated for 2-4 hours, depending on background. The breaker was also heated for several minutes during the early stages of evacuation.
3. The tube was then punctured and, while monitoring hydrogen and nitrogen, the sample gases were collected until these peaks reached a maximum.

The volume of the tube was determined by puncturing a number of good tubes under water and converting the weight of the water pulled into the tube into milliliters. The volume of the tube was calculated to be 0.15 ml and the volume of the mass spectrometer collection system was calculated to be 3.3 liters. The internal pressures should not be taken as exact pressures but treated as estimates. These results are shown in Table III.

The gas analysis confirmed that extremely high heater currents are due to the presence of hydrogen in the tube. Tubes 1, 2,

3, 4, 7, and 8 were tested soon after removal from the humidity test chamber. Tube 5 had been out of the humidity test chamber for about 5 months and tube 6 had been removed from the chamber for approximately 3 weeks. The extremely high pressure exhibited by tube 6 would tend to indicate a generation of hydrogen due to corrosion.

Tubes baked at 100°C in an oven did not show any failures. These tests were performed to eliminate the possibility of internal hydrogen generation as a cause of failure.

One test run of GL-7391's were performed. These have the same external parts as the JAN 6299 and results were comparable.

Tubes with part of the titanium hydride replaced with titanium powder were examined. This was done to decrease the amount of hydrogen released at exhaust. Poor seals were obtained due to poor wetting of the lead. The good tubes when submitted to the humidity test showed no improvement over production tubes.

Tubes with nickle-gold and copper-nickle-gold plating were humidity tested. The gold plating was immersion gold. The nickle gold plating look somewhat better than normal production; however, due to the failure rate of the copper-nickle-gold plated tubes, a re-evaluation of these results are necessary.

Results from humidity tests are found in Table IV.

Results from 100°C oven test and 100°C oven test vs. humidity test are found in Table V.

TABLE III

Mass Spectrometric Gas Content Analysis of 6299 Tube

Tube No.	I_f (ma)	Collection Time (Min.)	H_2	N_2	O_2	CH_4	A	Pressure mm H_g	Notes
1	310-310-310-310-310	2	-	-	-	-	-	-	Tube passed humidity test
2	320-600+	1	99.3	0.23	-	0.52	-	762	Humidity test failure 4 days
3	310-310-310-310-750	2	97.2	2.64	-	0.16	-	167	Tube #7 from humidity test 11-16-62
4	315-315-315-600-740	3	92.0	7.05	-	0.60	0.08	333	Tube #8 from humidity test 11-16-62
5	315-305-720-770-750	3	75.2	24.3	-	0.15	0.15	272	Tube from Eng. sample humidity test
6	385-560-770-800-710) 710-700-700-700-650)	35	68.9	30.6	-	0.10	0.10	1902	Tube from humidity test of GL-7391
7	315-560-510-500-500	2	-	81.6	16.5	0.45	1.10	312	Tube #17 from humidity test 11-16-62
8	310-310-310-600+-510	2	-	77.9	20.5	0.40	1.10	163	Tube #5 from humidity test 11-16-62

Performed by: B.I. Grady, Jr.
Chemical & Physics Laboratory
Advanced Development Eng.

TABLE IV

Humidity Test of SCS-90

All heater current readings are in milliamperes
10% allowable increase in I_f

6299 Engineering Samples
Tubes with 3 Hard Solder Seals
(Interrupted Humidity Test)

Date	5/18	5/23	8/9	8/17
Days	0	5	5	13
Tube No.				
1	309	400	670	650
2	310	435	475	470
3	311	490	515	505
4	311	440	565	650
5	314	304	305	290
6	315	305	720	770
7	313	303	295	295
8	310	435	430	720
9	313	304	300	295

% Rejects = 6/9 = 66%

6299 (Scranton Production)

Lot W/E 62-11

Days	0	4	10	14	18	21	34	56	53	58
Tube No.										
1	300	290	285	285	290	290	290	290	300	290
2	290	290	291	290	290	290	290	290	300	290
3	300	295	290	290	290	290	290	290	300	290
4	290	290	285	285	285	285	285	285	300	290
5	290	450	548	575	595	595	560	560	560	585
6	300	300	524	530	530	530	530	530	530	530
7	300	720	639	480	470	470	480	460	460	460
8	290	290	290	290	290	290	290	290	300	290
9	310	305	320	360	670	700	700	700	700	700
10	290	290	290	290	290	295	700	700	700	700
11	290	290	695	720	750	700	660	475	475	460
12	300	300	298	298	298	290	290	290	300	290
13	290	290	281	280	280	280	280	280	290	280
14	290	290	328	429	490	515	590	600	600	620
15	300	295	290	290	290	290	290	290	290	290
16	290	290	320	730	760	750	710	690	690	710

% rejects = 7/16 = 44%

GL-7391 (Scranton Production)

Lot W/E 62-15

Days	0	2	6	9	13	16	18	27	44
Tube No.									
1	380	385	385	380	380	380	380	380	380
2	382	385	385	390	390	380	380	600	650
3	386	385	385	385	385	380	380	380	380
4	380	380	380	380	380	380	380	380	380
5	385	385	385	380	380	380	380	500	490
6	390	390	395	390	390	390	390	750	650
7	388	390	390	380	380	380	380	380	650
8	380	380	380	380	380	380	380	380	390
9	385	720	570	590	650	650	600	600	600
10	382	380	380	380	380	380	380	700	700
11	382	380	490	710	760	760	750	700	700
12	380	380	380	380	380	380	380	390	600
13	385	385	385	380	380	380	380	750	700
14	390	800	730	830	700	700	700	700	700
15	390	390	390	390	390	385	390	390	400
16	385	385	385	390	390	390	380	390	390
17	385	385	385	380	380	380	380	380	380
18	385	560	770	800	710	710	700	700	700
19	380	380	380	380	380	380	380	390	700
20	385	385	385	385	590	600	600	600	600
21	385	380	380	380	380	380	380	390	700
22	405	405	405	605	870	800	800	750	750
23	385	385	385	380	380	380	380	380	390
24	370	370	370	370	370	370	370	370	380
25	400	400	400	400	400	400	400	405	480
26	388	390	390	385	385	800	800	800	700
27	385	385	840	825	820	800	750	750	700

% Rejects = 8/27 = 30%

6299 (Owensboro Production)

Lot W/E 62-46

Days	0	3	7	11	14
Tube No.					
1	310	310	310	310	310
2	310	310	310	310	310
3	310	310	310	310	310
4	310	310	310	310	310
5	310	310	310	600+	510
6	312	312	312	312	310
7	310	310	310	310	750
8	315	315	315	600+	740
9	310	310	310	310	310
10	320	320	320	320	320
11	312	312	312	312	310
12	310	310	310	310	310
13	320	320	320	320	390
14	300	310	320	600+	695
15	320	320	320	320	320
16	310	310	310	310	310
17	315	560	510	500	500
18	315	315	315	315	370
19	320	320	320	320	320
20	315	315	315	315	315

% rejects = 7/20 = 35%

6299 (Owensboro Production)

Lot W/E 62-46

Days	0	3	7	11	14
Tube No.					
1	310	310	310	310	310
2	310	310	310	310	310
3	310	310	310	310	310
4	310	310	310	310	310
5	310	310	310	600+	510
6	312	312	312	312	310
7	310	310	310	310	750
8	315	315	315	600+	740
9	310	310	310	310	310
10	320	320	320	320	320
11	312	312	312	312	310
12	310	310	310	310	310
13	320	320	320	320	390
14	300	310	320	600+	695
15	320	320	320	320	320
16	310	310	310	310	310
17	315	560	510	500	500
18	315	315	315	315	370
19	320	320	320	320	320
20	315	315	315	315	315

% rejects = 7/20 = 35%

6299 (Owensboro Production)

Part of Titanium Hydride replaced with Titanium Powder

Days	0	4	8	11	14
Tube No.					
1	310	315	315	315	315
2	317	317	317	320	320
3	317	317	317	320	320
4	315	315	320	320	320
5	320	320	325	320	360
6	319	500	590	590	640
7	320	320	320	320	320
8	318	318	320	320	320
9	311	310	312	310	310
10	310	310	312	330	320
11	312	312	310	310	340
12	320	600+*			
13	315	520	530	540	540
14	320	320	320	320	750+
15	319	320	320	390	750+
16	325	325	750	750+	750+

* Removed for Gas Analysis

% rejects = 8/16 = 50%

6299 (Owensboro Production)

light nickle plate and immersion gold plate

Day	0	4	7	11	14	17	24	45
Tube No.								
1	312	315	315	315	315	315	315	315
2	312	320	320	320	320	320	320	320
3	315	320	320	320	320	320	320	320
4	319	750+	550	510	510	510	510	510
5	319	320	320	320	320	320	320	320
6	310	320	320	320	320	320	320	320
7	400	340	320	320	320	320	750+	540
8	305	315	315	315	315	315	315	320
9	315	320	320	320	320	320	320	320
10	310	320	320	310	320	320	320	320
11	312	320	320	320	320	320	320	750+

% rejects = 1/11 = 9%

6299 (Owensboro Production)

heavy nickle plate and immersion gold plate

Day	0	4	7	11	14	17	24	45
Tube No.								
1	315	325	325	320	320	320	320	320
2	310	315	310	320	320	320	320	750+
3	315	320	320	320	320	320	320	660
4	315	320	320	320	320	330	320	570
5	315	320	320	320	320	320	320	320
6	320	325	330	330	330	330	320	320
7	320	320	320	320	320	330	320	320
8	310	340	360	750+	750+	750+	750+	750+
9	310	750+	750+	750+	750+	750+	750+	750+
10	320	325	325	325	325	325	325	330

% rejects = 2/10 = 20%

6299 (Owensboro Production)

light copper plate, light nickle plate, and immersion gold plate

Day	0	4	7	11	14	17	24
Tube No.							
1	310	320	320	320	470	470	470
2	315	320	320	320	320	320	320
3	309	320	320	320	320	320	460
4	315	325	325	325	500	620	620
5	315	750+	500	500	500	500	500
6	312	325	325	325	750+	750+	750+
7	315	320	320	320	320	320	670
8	314	320	320	310	320	320	360
9	315	320	320	320	320	320	520
10	320	325	325	325	325	325	740

% rejects = 4/10 = 40%

6299 (Owensboro Production)

heavy copper plate, heavy nickle plate, and immersion gold plate

Day	0	4	7	11	14	17	24
Tube No.							
1	320	325	750+	645	600	600	620
2	310	320	310	750+	700	520	640
3	335	340	680	700	750+	720	720
4	315	380	650	750+	750+	750	750
5	315	325	325	325	325	320	350
6	320	330	330	320	320	320	320
7	320	320	320	320	320	600	520
8	320	325	325	325	325	325	700
9	322	320	320	320	330	325	325
10	324	330	330	330	330	750+	750+

% rejects = 4/10 = 40%

TABLE V

100°C Oven Test

6299 (Scranton Production)

W/E 62-01

baked in oven 100°C

Days	0	1	7	15	21
Tube No.					
1	315	315	315	315	315
2	320	320	320	318	320
3	320	320	315	315	320
4	318	320	320	320	320
5	310	315	312	312	315
6	320	320	320	320	320
7	320	320	320	320	320
8	319	320	317	320	320
9	318	320	315	320	320
10	315	315	315	315	315
11	315	315	315	315	315
12	320	320	318	320	320

% rejects = 0/12 = 0%

6299 (Owensboro Production

Double Thickness of gold plating

	SCS-90 Humidity Test	
Days / Tube No.	0	6
1	318	750+
2	320	660
3	320	630
4	330	330
5	325	750
6	320	620
7	325	320
8	325	540
9	320	750
10	325	320
11	325	325
12	330	560
13	325	630
14	320	680
15	325	320
16	325	325
17	325	630
18	320	330
19	310	310
20	325	750+
21	325	325
22	320	560
23	320	750+
24	325	600
25	325	750+
26	330	330
27	330	750+
28	330	320
29	325	630

	100°C In Oven	
Days / Tube No.	0	8
1	320	320
2	320	320
3	320	320
4	330	325
5	325	325
6	330	330
7	330	330
8	320	320
9	330	330
10	330	330
11	330	330
12	330	330
13	330	330
14	320	320
15	325	325
16	320	320
17	325	325
18	325	325
19	320	320
20	325	325

% rejects 18/29 = 62%

% rejects = 0/20 = 0%

PROJECT IX IMPROVED EXHAUST FIXTURING

The purpose of this project is to further improve alignment and concentricity of the tube beyond that attained in Project I. Improvements made in Project I were attained by reductions in tolerences of tube parts. The basic limitation in making this improvement is the fixtures used to hold the tube's parts during the exhaust and sealing cycle. Present materials and design of fixtures are such that warping of the fixture takes place during exhaust.

Six possible improved designs have been fabricated and examined. Prints of these exhaust fixtures are included in the appendix. An alignment-assembly jig has been designed for use in conjunction with the exhaust fixtures. Upon investigation, the tungsten "spider" spring of designs #4, #5 and #6 proved to be extremely fragile and undesirable for production use. The molybdenum rocker washer of designs #2 and #4 produced a drain of heat at the grid, which caused very poor seals. Design #1 and #3 appear to show the most promise. The tungsten springs lost tension after several exhaust cycles; however, these designs have been returned to our equipment development operation for redesign of the tungsten springs for better hot strength. Upon return of these fixtures, sustained production will be run and concentricity measurements will be performed.

The alignment-assembly jig did not hold the base of the exhaust fixtures firmly enough when first tested. Slop in the holding of the exhaust fixture base would reflect itself in poor concentricity. This device has also been returned for redesign of the fixture which holds the base of the exhaust fixture. The redesigned alignment-assembly jig should be ready as soon or before the redesigned exhaust fixtures.

PROJECT X EXTENDED LIFE TEST AND TUBE FAILURE ANALYSIS

This contract and the present MIL specification on the JAN 6299 specify 1,000 hour life test. It is well recognized that much longer life than 1,000 hours of operation is desired in Signal Corps equipments. The purpose of this project is to determine the life results of the improved tube to 5,000 hours and to determine the nature of any resulting failures so that information can be made available for possible tube or manufacturing improvements. These data will provide reliability and failure rate data on the tube for 5,000 hours.

Thirty tubes will be equally divided into a control sample and a test sample. During life test, there will be reading periods of 100 hours between 0 and 1,000 hours and reading periods of 250 hours from 1,000 to 5,000 hours. At each reading the values of transconductance, noise figure, amplification factor, grid voltage, and capacitance will be recorded.

CONCLUSIONS

Project I, II and IV are 100% complete.

Project III is not on schedule due to delays incurred at Scranton. Since transfer to Owensboro, the revised schedule has been met.

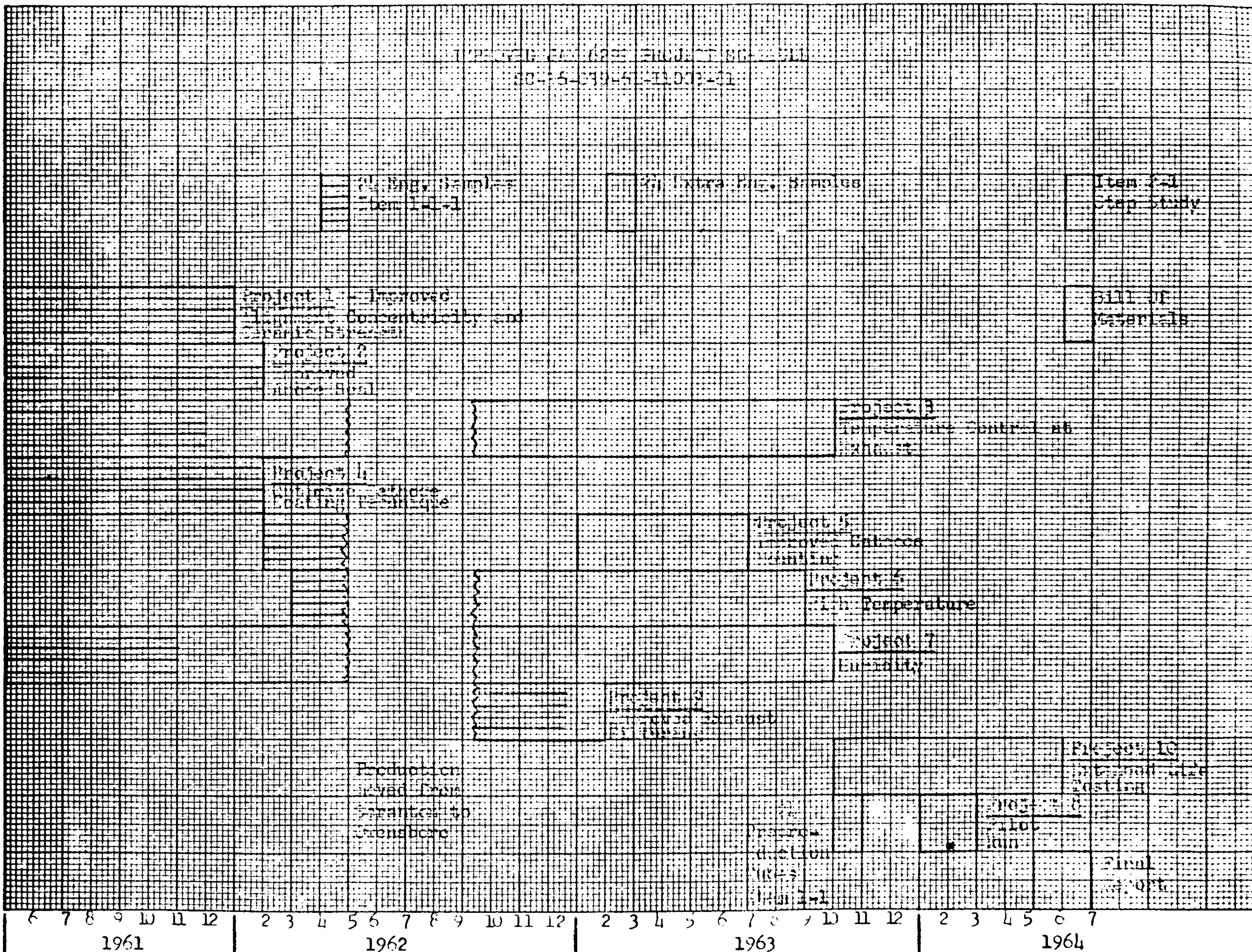
Tests performed on Project VI indicated that tubes must have hard solder anodes to withstand 225°C anode seal temperature consistently.

The mass spectrometric gas content analysis has shown that the majority of tubes failing SCS-90 humidity test do so because of the introduction of hydrogen into the tube. The source of the hydrogen has not been isolated.

Project IX has been delayed several weeks due to the necessity to redesign the springs of the exhaust fixtures to increase the hot strength. This project should be completed in time to include it in the 24 engineering samples to be constructed in February.

No work was scheduled in this interval on Project V and Project X.

A project schedule is included on the following page with the progress indicated on each project.


Project 1 - Improved
Concentricity and
Project 2
Project 3
Project 4
Project 5
Project 6
Temperature
Project 7
Project 8
Project 10
Bill of
Materials
Step Study
Production
Final
1961
1962
1963
1964

PROGRAM FOR THE NEXT INTERVAL

Project I - 100% complete

Project II - 100% complete

Project III - Run sustained sealing and exhaust cycles with the present processing duplicated and correlate this with seal quality. Connect two exhaust sets to one temperature controller and make the necessary adjustment for uniform results.

Project IV - 100% complete

Project V - Build tubes and finalize cathode foil size to give optimum cathode temperature. Determine best method to read cathode temperature.

Project VI - Continue to investigate gold plating preservation under high temperature. Test tubes with hard solder anodes and hard solder preseals to check survival with present processing. Investigate improved processing for high temperature life.

Project VII - Test current production tubes and evaluate efforts of temperature control at exhaust. Try to isolate whether hydrogen failures are caused by seal corrosion or base material corrosion.

Project VIII - Build 24 engineering samples to demonstrate the successful transfer of the facility to Owensboro.

Project IX - Evaluate the redesigned exhaust fixtures and modified alignment-assembly jig. Measure concentricity of tubes evaluated with those devices.

Project X - No work scheduled in the next quarter.

PUBLICATIONS, LECTURES,

REPORTS AND CONFERENCES

PUBLICATIONS - None

LECTURES - None

REPORTS - Monthly Narrative Report No. 13
Development of an Improved JAN 6299
by D. L. Cook for the period from
September 1962 to October 1962.

Monthly Narrative Report No. 14
Development of an Improved JAN 6299
by D. L. Cook for the period from
October 1962 to November 1962.

Monthly Narrative Report No. 15
Development of an Improved JAN 6299
by D. L. Cook for the period from
November 1962 to December 1962.

Monthly Narrative Report No. 16
Development of an Improved JAN 6299
by D. L. Cook for the period from
December 1962 to January 1963.

CONFERENCES - 1. Organization and personnel present:

USASSA
L. Coblentz

General Electric Company
A. T. Tomko   J. T. Duncan
E. L. Davis   D. L. Cook

Place and Date:
General Electric Company
Receiving Tube Department
Owensboro, Kentucky

September 12, 1962

CONFERENCES - Subject:

Review status of the contact and discuss the affects of the transfer of Production Engineering measures Contract No. DA-36-039SC-85953 (Type 6299) to Owensboro, Kentucky.

2. Organization and personnel present:

USASSA
L. Coblentz

General Electric Company
A. T. Tomko J. N. McClanahan
E. L. Davis D. L. Cook

Place and Date:
General Electric Company
316 E. Ninth Street
Owensboro, Kentucky

January 15, 1963

Subject:

Review status of the contract.

P E R S O N N E L

Listed below are the technical personnel who participated in the program during this reporting period. The approximate man-hours each spent is entered opposite his name. A biographical sketch of Mr. J. N. McClanahan appears in the Appendix.

A. T. Tomko	10	Hours
P. Kirby	19	Hours
B. I. Grady, Jr.	28	Hours
J. N. McClanahan	51	Hours
D. L. Cook	98	Hours

Submitted by:

D. L. Cook

D. L. Cook
Manufacturing Engineering
Receiving Tube Department

Approved by:

A. T. Tomko

A. T. Tomko, Manager
Production Engineering
Receiving Tube Department

A P P E N D I X

Personnel Biography

J. N. McClanahan

Mr. McClanahan, a native of Kansas, received his Bachelor's Degree in Electrical Engineering from the University of Kansas in June of 1962.

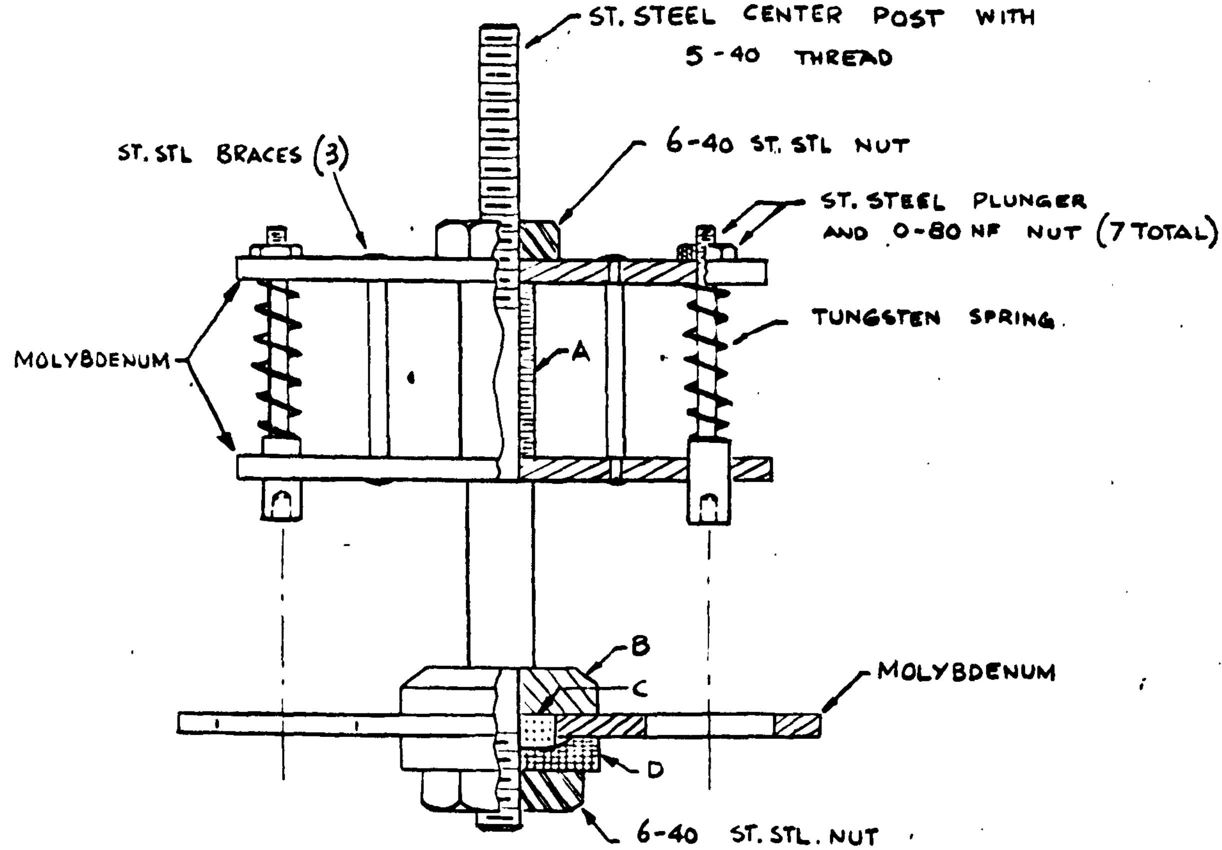
Upon graduation, he joined the Planar and Thyratron Section as a Process Control Engineer where he is working primarily on the Miniature Ceramic Lighthouse.

A P P E N D I X

Prints

GENERAL ELECTRIC

REV NO.	TITLE	CONT ON SHEET	SH NO.
	DESIGN #1 - EXHAUST FIXTURE		
CONT ON SHEET SH NO.	FIRST MADE FOR G.L. 6299		



UNLESS OTHERWISE SPECIFIED USE	APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS		
			FRACTIONS	DECIMALS	ANGLES
		✓	+ −	+ −	+ −

REVISIONS

PRINTS TO

A
B
C
D
} CERAMICS

MADE BY	L. KERSTEN	APPROVALS	DIV OR DEPT	
ISSUED	Oct 22-'62		LOCATION	CONT ON SHEET SH NO.

FF 803-F (8-60)
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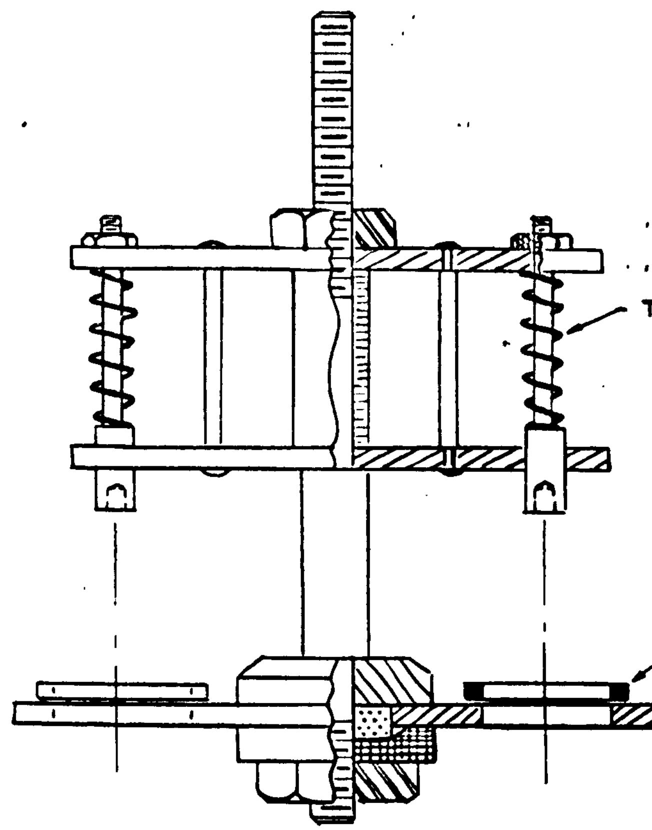
GENERAL ELECTRIC

REV NO.	TITLE	CONT ON SHEET	SH NO.
CONT ON SHEET / SH NO.	DESIGN #2 - EXHAUST FIXTURE		
	FIRST MADE FOR G.L. 6299		



UNLESS OTHERWISE SPECIFIED USE	APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS		
			FRACTIONS	DECIMALS	ANGLES
		✓	+ −	+ −	+ −

REVISIONS

PRINTS TO

MADE BY	L. KERSTEN	APPROVALS	DIV OR DEPT	
ISSUED	OCT 22-'62		LOCATION	CONT ON SHEET SH NO.

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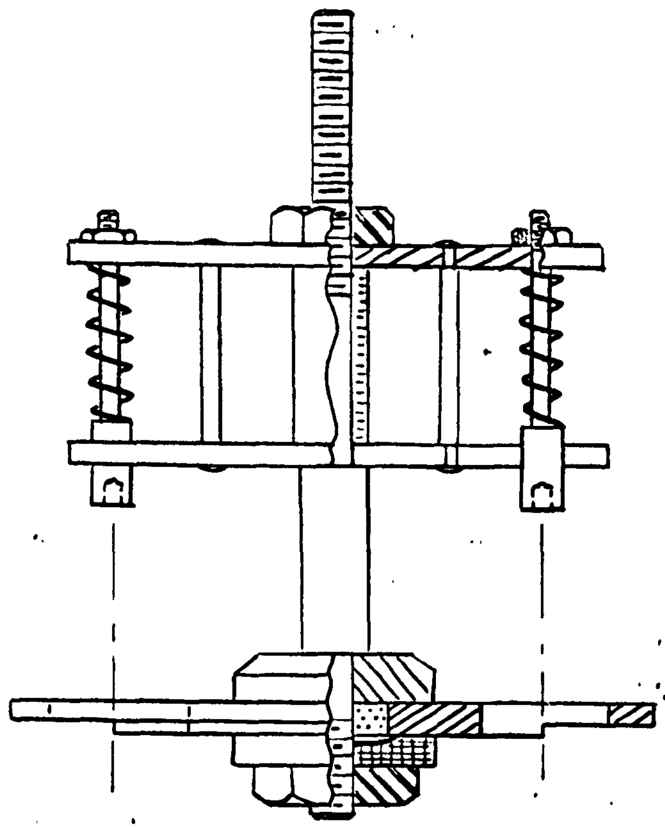
GENERAL ELECTRIC

REV NO.	TITLE	CONT ON SHEET SH NO.
CONT ON SHEET SH NO.	DESIGN #3 – EXHAUST FIXTURE FIRST MADE FOR G.L. 6299	



UNLESS OTHERWISE SPECIFIED USE	APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS		
			FRACTIONS	DECIMALS	ANGLES
		✓	±	±	±

REVISIONS

PRINTS TO

MADE BY L. KERSTEN	APPROVALS	DIV OR DEPT	
ISSUED Oct 22-'62		LOCATION	CONT ON SHEET SH NO.

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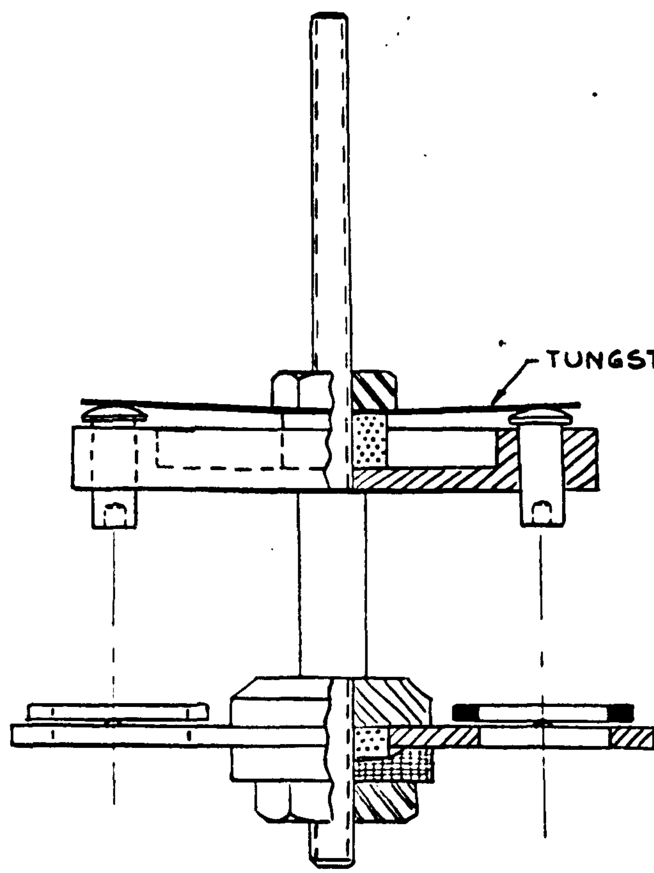
GENERAL ELECTRIC

REV NO.	TITLE	CONT ON SHEET	SH NO.
CONT ON SHEET SH NO.	DESIGN #4 - EXHAUST FIXTURE		
	FIRST MADE FOR G.L. 6299		



UNLESS OTHERWISE SPECIFIED USE	APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS FRACTIONS	DECIMALS	ANGLES
		✓	+ −	+ −	+ −

REVISIONS

PRINTS TO

MADE BY L. KERSTEN	APPROVALS	DIV OR DEPT	
ISSUED Oct 22-'62		LOCATION	CONT ON SHEET SH NO.

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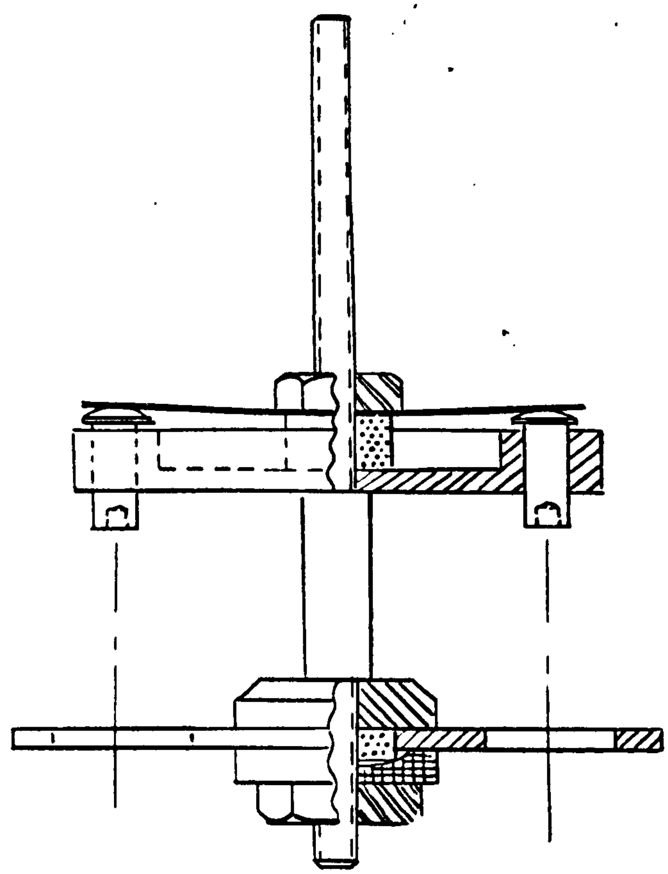
GENERAL ELECTRIC

REV NO.	TITLE	CONT ON SHEET	SH NO.
	DESIGN # 5- EXHAUST FIXTURE		
CONT ON SHEET SH NO.	FIRST MADE FOR G.L. 6299		



UNLESS OTHERWISE SPECIFIED USE	APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS		
			FRACTIONS	DECIMALS	ANGLES
		✓	+ −	+ −	+ −

REVISIONS

PRINTS TO

MADE BY	APPROVALS	DIV OR DEPT	
ISSUED		LOCATION	CONT ON SHEET SH NO.

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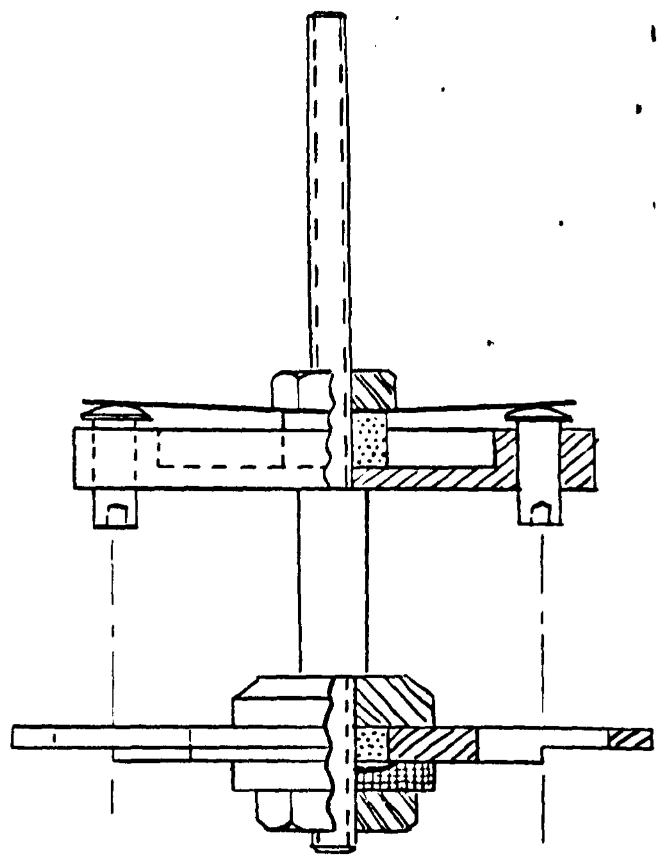
GENERAL ELECTRIC

REV NO.	TITLE	CONT ON SHEET	SH NO.
CONT ON SHEET SH NO.	Design # 6- Exhaust Fixture		
	FIRST MADE FOR G.L. 6299		



UNLESS OTHERWISE SPECIFIED USE	APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS		
			FRACTIONS	DECIMALS	ANGLES
		✓	+ −	+ −	+ −

REVISIONS

PRINTS TO

MADE BY	APPROVALS	DIV OR DEPT	
ISSUED		LOCATION	CONT ON SHEET SH NO.